

## **Comments on Forecast Verification during the ORD and Beyond**

4 August 2003

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Verification is an essential component of the forecast process – especially at times of change. Objectives of a comprehensive verification system include delivering real-time feedback to the forecaster, retrospectively identifying strengths and weaknesses of both forecasters and numerical models to improve their accuracy and skill, providing information to management for evaluation of organizational efficiency, and providing a basis for users to take maximum advantage of our forecasts. A useful verification system also depends upon forecasters being presented clearly defined goals.

In June 2002, the National Weather Service formed the National Verification Integrated Work Team (NVIWT), recognizing the key role verification should play within the digital forecast infrastructure. The NVIWT is tasked with advocating and overseeing the development of a system that provides meaningful measures of forecast accuracy and a means for forecast improvement. The IFPS Science Steering Team (ISST) supports the goals and efforts of the NVIWT.

The ISST advocates a system that provides gridded verification at spatial and temporal scales commensurate with the resolution of the gridded forecasts. Such a system critically depends upon a target grid (the ground truth) being provided to the forecasters to establish both consistency and value. Without such a grid, an effort to measure quality and establish benchmarks is nearly meaningless. Point forecasts (e.g., forecasts at ASOS and MOS sites) continue to be desirable, but the strength of a verification system for a gridded forecast is a compatible verification grid. Until this goal can be reached, verification remains a troublesome issue.

The Operational Readiness Demonstration (ORD) was conducted without the type of “end state” verification system envisioned by the NVIWT and the ISST; however, progress is being made. MDL is distributing statistical information from a system designed to serve as a prototype for digital forecast verification. The initial data consist of the following: (1) A comparison between MOS guidance and NDFD forecasts interpolated to MOS sites, and (2) A comparison of NDFD forecasts at 5 km grid spacing with RUC analyses at 20 km grid spacing.

Verification with an “analysis grid of record” matching the same grid spacing as the highest resolution forecast grid is a necessity. The resolution of the current RUC grid will not provide sufficient information to create a true measure of forecast accuracy, nor will it assist the forecaster in evaluating his/her work in the most desirable manner. Using the 20 km RUC grid for verification is a reasonable start, but the mismatch in resolution should be eliminated. The analysis grid of record should also be as independent as possible of a numerical weather prediction model.

In the new gridded forecast era, assessing verification scores at established CCF sites must be done from a perspective that differs from our traditional methods. Historically, forecasters have focused on the weather, temperature, and probability of precipitation at precise locations where there were *in situ* observations. An awareness of site-specific terrain, vegetation, and small scale climate anomalies frequently entered into the decision making process. In contrast, today's forecasts for these same locations are interpolations of values from nearby grid points with none of the smallest scales of variability represented. Thus, the two methods should be expected to result in forecast differences for the same station at the same time. This dictates that a new baseline for assessing "point" forecast verification in the gridded forecast era must be established. An alternative would be the continuation of a true point forecast system for the limited set of CCF points.

Currently, there are insufficient definitions and standardized procedures to ensure forecasts of equal quality will match at CWA boundaries. The potential for such inconsistencies provides additional possibilities for misleading verification. For example, forecasters in adjacent CWAs can use different editing techniques and concepts to prepare a gridded forecast of the same field. One office might want to represent a smoothed sky condition over a longer time period grid, while another might want to emphasize specific timing and detail of a certain sky condition in shorter time period grids. This scenario depicts two offices using different temporal definitions: mean sky condition for a period and instantaneous sky condition, respectively. Each forecast grid is based upon solid meteorological reasoning and consistent with stated procedures, yet results in forecasts for adjacent grid points that don't meet discrepancy criteria. A verification system that doesn't take this variability into account can be misleading. If a well collaborated, consistent or "seamless" NDFD is the goal; forecasters must be provided definitions and standards that will provide a common target and consistent measure of quality. Only then will national verification offer meaningful results.

Any attempt to evaluate published forecasts, numerical models, and statistical model performance from ORD, and beyond, should only be undertaken with full recognition of the fact that both the forecast and the verification processes differ from traditional NWS methods. Furthermore, it should acknowledge there are significant inconsistencies and omissions in the current trial system that prevents it from providing meaningful results. The ISST feels few, if any, decisions on future direction should be grounded in these results. Rather, the ORD verification should be considered an early test of process and procedure for this new era. Addressing the concerns expressed in this statement will help forecasters develop a clearer understanding of the expectations regarding the quality of their forecasts. A gridded verification system compatible with the detail of the NDFD will provide the means for improving forecast skill and accuracy while targeting NWS mission goals.